IN THE CLAIMS

1.-32. (canceled)

33. (new) A process for producing a casting of a magnesium alloy in a pressure casting machine having a supply of molten magnesium alloy, a mould or die which defines a die cavity, and a metal flow system which communicates with the die cavity through a die or mould tool means;

wherein the process comprises the steps of:

(a) supply molten alloy under pressure from the supply thereof whereby the alloy is able to flow along a runner defined by the tool means and then through a controlled expansion region of the tool means before passing through a gate to enter the die cavity; and

(b) controlling flow velocities of alloy flowing in the runner and through the expansion region whereby the alloy flowing through the expansion region spreads laterally therein, with respect to its direction of flow, and thereby undergoes a reduction in flow velocity relative to the flow velocity in the runner;

wherein the controlling of step (b) provides a flow velocity in the runner and a reduction in flow velocity in flow through the expansion region whereby alloy supplied by step (a) undergoes a change from a molten state to a semi-solid state and substantially all alloy flow through the gate and into the die cavity is in said semi-solid state.

34. (new) The process according to claim 33, wherein the gate and runner are formed such that an effective cross-sectional area of flow through the gate exceeds an effective cross-sectional area of flow through the runner whereby the alloy has a velocity through the effective cross-sectional area of flow through the runner which exceeds its velocity through the gate.

35. (new) The process according to claim 34, wherein the cross-sectional area of flow through the gate exceeds the effective cross-sectional area of flow through the runner to an extent resulting from a ratio of those areas in the range of about 2:1 to 4:1.

36. (new) The process according to claim 33, wherein the gate defines an outlet end of the controlled expansion region.

37. (new) The process according to claim 33, wherein the controlled expansion region is provided by a step-wise increase in cross-section from the effective cross-section of the runner whereby there is a step-wise reduction of alloy flow velocity in said region.

38. (new). The process according to claim 33, wherein the controlled expansion region progressively increases in cross-section in the direction of alloy flow therethrough whereby there is a progressive reduction in alloy flow velocity in said region.

39. (new) The process according to claim 33, wherein the system is operable to achieve a velocity of alloy through the runner with the range of about 140 m/s to 165 m/s.

40. (new) A process according to claim 39, wherein the velocity in said range is about 150 m/s.

41. (new) The process according to claim 33, wherein the system is operable to achieve an alloy flow velocity through the controlled expansion region which is about 25% to 50% less than the flow velocity through the runner.

42. (new) The process according to claim 41, wherein the alloy flow velocity through the controlled expansion region is about two-thirds of the flow velocity through the runner.

43. (new) The process according to claim 33, wherein the runner has a designed cross-sectional area which substantially defines the effective cross-sectional area of flow therethrough.

44. (new) The process according to claim 43, wherein filling of the die cavity is achieved by moving fronts of semi-solid metal advancing away from the gate.

45. (new) A process for producing a casting of a magnesium alloy, using a pressure casting machine having a mould or die which defines a die cavity, wherein the process includes the steps of:

(i) supplying molten magnesium alloy to a metal flow system which includes a die or mould tool means which defines:

(a) at least one runner of the system; and

(b) at least one controlled expansion region;

whereby the supplied alloy flows through the runner and then through the expansion region prior to flow into the die cavity; and

(ii) controlling alloy flow velocities in said flow system by allowing the alloy flowing through the controlled expansion region to spread laterally, with respect to the direction of flow, to attain a resultant reduction in alloy flow velocity, relative to the alloy flow velocity in the runner, whereby substantially all metal flow throughout the die cavity is in a viscous or semi-solid state.

46. (new) The process according to claim 45, wherein the alloy flow velocity through the controlled expansion region is from about 25% to 50% less than the flow velocity through the runner.

47. (new) The process according to claim 45, wherein the process is used with a machine with which the system achieves an alloy flow velocity through the runner within the range of from about 140 m/s to 165 m/s.

48. (new) The process according to claim 46, wherein the process is used with a machine with which the system achieves an alloy flow velocity through the runner within the range of from about 140 m/s to 165 m/s.

49. (new) In a process for pressure casting magnesium alloy in a die cavity, by a flow in a flow direction defined by a runner of the magnesium alloy in a molten state, the

improvement comprising:

passing the flow of the magnesium alloy from the runner through an expansion region from which the alloy is able to flow into the die cavity, spreading the flow of the magnesium alloy laterally of the flow direction in the expansion region and thereby sufficiently reducing a velocity of the flow of the magnesium alloy below a sufficient initial value to change the magnesium alloy in the expansion region from the molten state to a semi-solid state whereby flow of alloy substantially throughout the die cavity is in the semi-solid state.

50. (new) A metal flow system, for use in pressure casting of magnesium alloy in a pressure casting machine having a supply of molten magnesium alloy and a mould or die which defines a die cavity;

wherein the metal flow system includes a die or mould tool means which defines:

(i) a runner into which molten magnesium alloy is able to be received under pressure for injection into the die cavity, and

(ii) a controlled expansion region through which alloy received from the runner is able to pass before being injected through a gate defining an inlet to the die cavity; and

wherein the flow system has a form providing for control of alloy flow velocities therein, said form of the flow system comprising:

(i) an effective cross-sectional area of the runner for determining the flow velocity of alloy received under pressure therein; and

(ii) a form of said expansion region which enables alloy flow therein to spread laterally, with respect to its direction of injection, and thereby undergo a reduction in flow velocity in the expansion region relative to the alloy flow velocity in the runner;

whereby said form of the flow system enables a said flow velocity in the runner and a said reduction in flow velocity in the expansion region by which the state of the alloy is changed from a molten state in the runner to a semi-solid state for flow through the gate and into the die cavity.

51. (new) The system according to claim 50, wherein the flow system includes said gate and the controlled expansion region terminates adjacent to the gate.

52. (new) The system according to claim 51, wherein the gate and runner are such that an effective cross-sectional area of flow through the gate exceeds an effective cross-sectional area of flow through the runner whereby the alloy has a velocity through the effective cross-sectional area of flow through the runner which exceeds its velocity through the gate.

53. (new) The system according to claim 52, wherein the cross-sectional area of flow through the gate exceeds the effective cross-sectional area of flow through the runner to an extent resulting from a ratio of those areas in the range of about 2:1 to 4:1.

54. (new) The system according to claim 50, wherein the controlled expansion region is provided by a step-wise increase in cross-section from the effective cross-section of the runner whereby a step-wise said reduction in flow velocity is enabled.

55. (new) The system according to claim 50, wherein the controlled expansion region progressively increases in cross-section in the direction of alloy flow therethrough, whereby a progressive said reduction in flow velocity is enabled.

56. (new) The system according to claim 50, wherein the system is adapted for use in pressure casting with a given machine with which it is operable to achieve a velocity of alloy through the runner with the range of about 140 m/s to 165 m/s.

57. (new) The system according to claim 56, wherein the system is so adapted whereby the velocity in said range is about 150 m/s.

58. (new) The system according to claim 150 wherein the system is operable to achieve a flow velocity of alloy through the controlled expansion region which is about 25% to 50% less than the velocity of flow through the runner.

59. (new) The system according to claim 26, wherein the system is so operable whereby the velocity through the controlled expansion region is about two-thirds of the velocity through the runner.

60. (new) The system according to claim 50, wherein the runner has a designed cross-sectional area which substantially defines the effective cross-sectional area of flow therethrough.

61. (new) The system according to claim 50, wherein said system is operable to achieve filling of the die cavity by moving semi-solid fronts of metal.

62. (new) A metal flow system, for use in pressure casting of molten magnesium alloy, using a pressure casting machine having a mould or die which defines a die cavity, wherein the system includes a die or mould tool means which defines:

(a) at least one runner of the system through which molten alloy is able to flow; and

(b) at least one controlled expansion region of the system through which alloy is able to flow from the runner before flowing into the die cavity;

wherein the controlled expansion region is of a form whereby alloy flowing therethrough is able to spread laterally, with respect to the direction of alloy flow, with a resultant reduction in alloy flow velocity relative to the alloy flow velocity in the runner; and wherein the flow system is of a form providing for control of metal flow velocities therein whereby substantially all of the alloy flowing throughout the die cavity is in a semi-solid state and thereby enables production of a magnesium alloy casting substantially free of surface defects.

63. (new) The system according to claim 62, wherein the system is operable to achieve an alloy flow velocity through the controlled expansion region which is from about 25% to 50% less than the flow velocity through the runner.

64. (new) The system according to claim 62, wherein the system is adapted for use in pressure casting with a given machine with which the system is operable to achieve an alloy flow velocity through the runner within the range of from about 140 m/s to 165 m/s.

65. (new) The system according to claim 63, wherein the system is adapted for use in pressure casting with a given machine with which the system is operable to achieve an alloy flow velocity through the runner within the range of from about 140 m/s to 165 m/s.

66. (new) In a system for pressure casting magnesium alloy in a die cavity from a flow in a flow direction defined by a runner of the magnesium alloy in a molten state, the improvement comprising:

an expansion region for passing the flow of the magnesium alloy from the runner into a flow substantially throughout the die cavity, for spreading the flow of the magnesium alloy laterally of the flow direction and for sufficiently reducing a velocity of the flow of the magnesium alloy below a sufficient initial value to change the magnesium alloy in the expansion region from the molten state to a semi-solid state for the flow substantially throughout the die cavity.

67. (new) The process according to claim 39, wherein the system is operable to achieve an alloy flow velocity through the controlled expansion region which is about 25% to 50% less than the flow velocity through the runner.